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JACOBSON HOLMAN, PLLC.
PROFESSIONAL LIMITED LIABILITY COMPANY
400 Seventh Street, N.W.
Washington, DC 20004

EXAMINER	
BAYARD, EMMANUEL	
ART UNIT	**PAPER NUMBER**
2631	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/025,797	Applicant(s) KIM ET AL.	
	Examiner Emmanuel Bayard	Art Unit 2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 December 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/26/01*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Sawahashi et al U.S. Patent No 6,069,912.

As per claims 1, 13 and 20 Sawahashi et al teaches an adaptive RAKE receiving apparatus constrained with at least one constraint in a mobile communication system, the apparatus comprising: input signal generating means for generating a complex received signal by gathering multi-path components (see fig.5 elements 504-1-504-L and col.3, lines 10-67 and col.9, line12-13) during a corresponding transmitting signature; a matched flier is the same as the claimed (adaptive filtering means) (see fig.5 elements 505a-505c, and col.9, lines 14-25) for filtering the complex received signal based on a tab weight (see elements 506a-506c) that is adjusted at a predetermined period; channel estimating means for estimating (see fig.5 elements 509, 510 and col.8, lines 5-7 and col.9, lines 26-26, 52-55) a phase component and an amplitude component of a particular user channel by using the filtered signal from the adaptive filtering means to generate a channel estimating result signal; signal recovering means for recovering an original signal, which was transmitted from a particular user, by combining (see fig.5 element 511 and col.9, lines 17, 45-47) the

filtered signals from the adaptive filter means for all multi-path components and the channel estimating result signal from the channel estimating means; a decision portion or judgment portion is the same as the claimed (selecting means) (see fig.5 element 512 and col.9, lines 47-55) for selecting one between a predetermined trained data signal and the recovered signal from the signal recovering means; reference signal generating means (see fig.5 element 516 and col.9, lines 28-55) for generating a reference signal by using the selected signal from the decision (selecting) means and the channel estimation result signal from the channel estimating means; error calculating means (see fig.5 element 515 and col.9, lines 27-40) for comparing the filtered received signal from the adaptive filtering means with the reference signal from the reference signal generating means to calculate error between these compared two signals; and tap coefficient adjusting means (see fig.5 element 517 and col.9, lines 20-50) for adjusting tap coefficients of the adaptive filtering means based on MMSE (Minimum Mean Square Error) criterion with at least one constraint (constraint MMSE criterion).

As per claim 2, Sawahashi et al inherently includes, wherein the constraint MMSE criterion is defined as:J.ident.E.left brkt-bot..vertline..sub.l(n)d.sub.- 1(n)-w.sub.l(n) .sup.Hr.sub.l(n). vertline..sup.2.right brkt-bot. subject to w.sub.l(n).sup.Hs.sub.1=1where J is the constraint MMSE criterion, E represents a mean value, .sub.l(n) is an estimated channel for the l-th multi-path component, d.sub.1(n) is the selected signal from the selecting means, w.sub.l(n) is an adaptive filter coefficient vector, and a superscript H represents Hermitian operation, and a

product of the tap coefficient w.sub.l(n) of the adaptive filtering means and a spread code vector s, is constrained to be substantially 1 so that the error calculated at the error calculating means is minimized.

As per claim 3, Sawahashi et al inherently includes, wherein the tap coefficient of the adaptive filtering means for the l-th multi-path component is orthogonal-separated into a spreading code vector and an adaptive component orthogonal to the spreading code vector expressed as:w.sub.l(n)=s.sub.1+x.sub.l(n)where s.sub.1 is the spreading code vector and x.sub.l(n) is the adaptive component of the tap coefficient vector, these two vectors being orthogonal to each other, the adaptive component orthogonal to the spreading code vector is changed by using a component of the received signal, which is projected into the adaptive component orthogonal to the spreading code vector rather than using directly the received signal.

As per claim 4, Sawahashi et al inherently includes, wherein the constraint MMSE criterion is defined as:J.ident.E.left brkt-bot..vertline.{circumflex over (v)}.sub.l(n)d.sub.1(n)-w.sub.l(n).sup.Hr(n).vertline..sup.2.right brkt-bot. subject to w.sub.l(n)=u.sub.1l+z.sub.l(n) and z.sub.l(n).perp.Range (U)where J is the constraint MMSE criterion, E represents a mean value, .sub.l(n) is an estimated channel for the l-th multi-path component, d.sub.1(n) is the output signal from the selecting means, w.sub.l(n) is an adaptive filter coefficient vector, and a superscript H represents Hermitian operation, the inner product of the tap coefficient w.sub.l(n) of the adaptive filtering means for the l-th multi-path component and the spreading code vector s.sub.1l

for the corresponding multi-path component is constrained to be substantially 1 and the inner product of the tap coefficient w.sub.l(n) of the adaptive filtering means for the l-th multi-path component and the spreading code vector s.sub.1l (l.noteq.1) for other corresponding multi-path component is constrained to be substantially 0 so that the error that is calculated by the error calculating means is minimized.

As per claim 5, Sawahashi et al inherently includes wherein the tap coefficient of the adaptive filter means for the l-th multi-path component is orthogonal-separated into a spreading code vector and an adaptive component orthogonal to the spreading code vector as:w.sub.l(n)={overscor- e (s)}.sub.1l+x.sub.l(n)where {overscore (s)} .sub.1l= S(S.sup.HS). sup.-1f.s- ub.l, f.sub.l is a L-by-1 column vector with all elements 0's except 1 at the l-th position and x.sub.l(n) is the adaptive component of the tap coefficient vector, x.sub.l(n) being orthogonal to a range spanned by S, i.e., x.sub.l(n).perp. Range(S), the adaptive component orthogonal to the spreading code vector is changed by using a component of the received signal, which is projected into the adaptive component orthogonal to the spreading code vector rather than using directly the received signal.

As per claim 6, Sawahashi et al inherently includes, wherein the constraint MMSE criterion for updating the coefficient of the adaptive filtering means for the l-th multi-path component is implemented by orthogonal separation LMS (least mean square) algorithm as:x.sub.l(n+1)=x.sub.l(n)+.mu..multido t.e.sub.l(n). sup..times.. multidot.P. sub.s.sup..perp.r(n) where e.sub.l(n).ident..sub.l(n)d.sub.1(n)- w.sub.l(n).sup.Hr(n), i.e., the difference between the product of the channel estimation

value and data and the output of the adaptive filtering means, and P.sub.S.sup..perp.=I-S(S.sup.HS).sup.-1S.sup.H, P.sub.S.sup..perp.r(n) being a component of r(n) projected into x.sub.l(n), .mu. is a step size that determines the rate at which the tap coefficient changes, and a superscript * represents complex conjugate operation.

As per claim 7, Sawahashi et al inherently includes, wherein, in order to estimate the channel for the l-th multi-path component, the channel estimating means multiplies the outputs of the adaptive filtering means for the multi-path components with the complex conjugate of data for a predetermined number of the pilot symbol and averages the multiplied results as follows: 5 c ^ i = 1 N p i = 1 N p b 1 * (n - iQ) w i H (n - iQ) r i (n - iQ) where N.sub.p is the number of the pilot symbols used for the channel estimation and Q is an inserting period of the pilot symbol.

As per claim 8, Sawahashi et al inherently includes, where the constraint MMSE criterion is defined as:J.ident.E.left brkt-bot..vertline.{circumflex over (v)}.sub.l(n)d.sub.1(n)-w.sub.l(n).sup.Hr(n).vertline..sup.2.right brkt-bot. subject to w.sub.l(n)=u.sub.1l+z.sub.l(n) and z.sub.l(n).perp.Range (U)where J is the constraint MMSE criterion, E represents a mean value, {circumflex over (v)}.sub.l(n) is a coefficient estimated by the l-th basis component, d.sub.l(n), is the output of the selected means, z.sub.l(n) is a variable component of an adaptive filter coefficient, r(n) is an adaptive filter input signal vector, U=[u.sub.11 u.sub.12 . . . u.sub.1L] is a matrix constructed by L left singular vectors of S=[s.sub.11 s.sub.12 . . . s.sub.1L] and a superscript H represents Hermitian operation, the inner product of the tap coefficient w.sub.l(n) of the adaptive filtering means for the l-th multi-path component and the spreading

code vector s.sub.1l for the corresponding multi-path component is constrained to be substantially 1 and the inner product of the tap coefficient w.sub.l(n) of the adaptive filtering means for the l-th multi-path component and the spreading code vector s.sub.l (l.noteq.1) for other multi-path components is constrained to be substantially 0 so that the error that is calculated by the error calculating means is minimized.

As per claim 9, Sawahashi et al inherently includes, wherein the tap coefficient of the adaptive filtering means for the l-th multi-path component is orthogonal-separated into a spreading code vector and an
adaptive component orthogonal to the spreading code vector as:w.sub.l(n)=u.sub.1l+-z.sub.l(n)where u.sub.1l is the l-th left singular vector of the spreading code matrix S and z.sub.l(n) is the adaptive component of the tap coefficient vector, z.sub.l(n) being orthogonal to the range spanned by U, i.e., z.sub.l(n).perp.Range(U), the adaptive component orthogonal to the spreading code vector is changed by using a component of the received signal, which is projected into the adaptive component orthogonal to the spreading code vector rather than using directly the received signal.

As per claim 10, Sawahashi et al inherently includes, wherein the constraint MMSE criterion for updating the coefficient of the adaptive filtering means for the l-th multi-path component is implemented by orthogonal separation LMS (least mean algorithm) expressed as:z.sub.l(n+1)=z.sub.l(n)+.mu..mult- idot.e.sub.l(n)* .multidot.P.sub.U.sup..perp.r(n)where e.sub.l(n).ident.{circumflex over (v)}.sub.l(n)d.sub.1(n)-w.sub.l(n).sup.- Hr(n), i.e., the difference between the product of the channel estimation and data and the output of the adaptive filtering means,

P.sub.U.sup..perp.=I-U(U.sup.HU).sup.-1U.sup.H=I-UU.sup.H, P.sub.U.sup..perp.r(n) is a component of r(n) projected to z.sub.l(n), .mu. is a step size that is a rate at which the tap coefficient is changed, and a superscript * represents complex conjugate operation.

As per claim 11, Sawahashi et al inherently includes, wherein, in order to estimate the channel for the l-th multi-path component, the channel estimating means multiplies the outputs of the adaptive filtering means for the multi-path components with the complex conjugate of data for a predetermined number of the pilot symbol and averages the multiplied values by an equation expressed as: 6 v ^ i =1 N p i = 1 N p b 1 * (n - iQ) w i H (n - iQ) r (n - iQ) where N.sub.p is the number of the pilot symbols used for the channel estimation and Q is an inserting period of the pilot symbol.

As per claim 12, Sawahashi et al inherently includes, wherein the channel estimating means estimates the channels for all of the multi-path components by using the outputs of the adaptive filtering means, and the output of the selecting means for the predetermined number of the pilot symbols expressed as: 7 [c ^ 1 (n) c ^ L (n)] = [1 w 1 H (n) s 1 (2 - 1) w 1 H (n) s 1 (L - 1) w L H (n) s 1 (1 - L) w L H (n) s 1 (2 - L) 1] - 1 [b 1 * (n) w 1 H (n) r 1 (n) b 1 * (n) w L H (n) r L (n)] where s.sub.1(p) is a p chip-shifted version of s.sub.1=[s.sub.11 s.sub.12 . . . s.sub.1,N-1 s.sub.1,N].sup.T that is a normalized spreading code for the first user, p being an arbitrary integer, if p is a positive integer, s.sub.1(p)=[0.sub.p s.sub.11 s.sub.12 . . . s.sub.1,N-p].sup.T and if p is a negative integer, s.sub.1(p)=[s.sub.1,-p+1 s.sub.1,-p+2 . . . s.sub.1,N 0.sub.p].sup.T, 0.sub.p being a 1.times.p 0 vector, (.tau..sub.i-.tau..sub.l)

being the transmission delay difference between the i-th multi-path component and the l-th multi-path component, which is integer times of a chip.

As per claim 14, Sawahashi et al includes, wherein the step (b) includes the steps of: (g) gathering each of the multi-path components corresponding to the transmitted signature to provide them to each of the adaptive filters; and (h) filtering the complex received signal by using the input of the adaptive filter and the coefficient of the adaptive filter (see fig.5).

As per claim 15, Sawahashi et al includes, wherein the step (b) includes the step of: (i) compensating transmission delays (see fig.5 elements 518a-518c, 510) of the multi-path components and gathering the compensated received signals to provide them to each of the adaptive filters.

As per claim 16, Sawahashi et al inherently includes, wherein the step (g) includes the step of: (i) gathering the received signal corresponding to period from a starting chip of a transmitted symbol of the firstly received multi-path component among the multi-path components to a final chip of the transmitted symbol of a last received multi-path component among the multi-path components to provide the gathered signals to each of the adaptive filters (see fig.5).

As per claim 17, Sawahashi et al inherently includes, wherein the step (c) includes the steps of: (j) estimating the channel for each of the multi-path components by using the pilot symbol; and (k) multiplying the complex conjugate value of each of the estimated channel value with the output of the adaptive filter for the corresponding

multi-path component, and summing up the multiplied values for all of the multi-path components to decide channel estimation value for the transmitted signal (see fig.5).

As per claim 18, Sawahashi et al inherently includes, wherein the step (j) includes the step of: (l) estimating the channel by maximum likelihood combination by using the outputs of the adaptive filters for all the multi-path components and the output of the selecting means (see fig.5).

As per claim 19, Sawahashi et al includes, wherein the step (d) includes the step of: (m) deciding (see element 512)a transmitted data; and (n) generating a reference signal (see output of element 516) by using the decided data and the channel value.

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tsutsui et al U.S. Patent No 6,385,181 B1 teaches an array antenna system (*).

Sawahashi et al U.S. Patent No 5,694,388 teaches a CDMA demodulator (*).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emmanuel Bayard whose telephone number is 571 272 3016. The examiner can normally be reached on Monday-Friday (7:Am-4:30PM) Alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammed Ghayour can be reached on 571 272 3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Emmanuel Bayard
Primary Examiner
Art Unit 2631

4/22/05

EMMANUEL BAYARD
PRIMARY EXAMINER